

SHIP PRODUCTION COMMITTEE  
FACILITIES AND ENVIRONMENTAL EFFECTS  
SURFACE PREPARATION AND COATINGS  
DESIGN/PRODUCTION INTEGRATION  
HUMAN RESOURCE INNOVATION  
MARINE INDUSTRY STANDARDS  
WELDING  
INDUSTRIAL ENGINEERING  
EDUCATION AND TRAINING

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NSRP 0006

# **THE NATIONAL SHIPBUILDING RESEARCH PROGRAM**

## **Proceedings of the REAPS Technical Symposium**

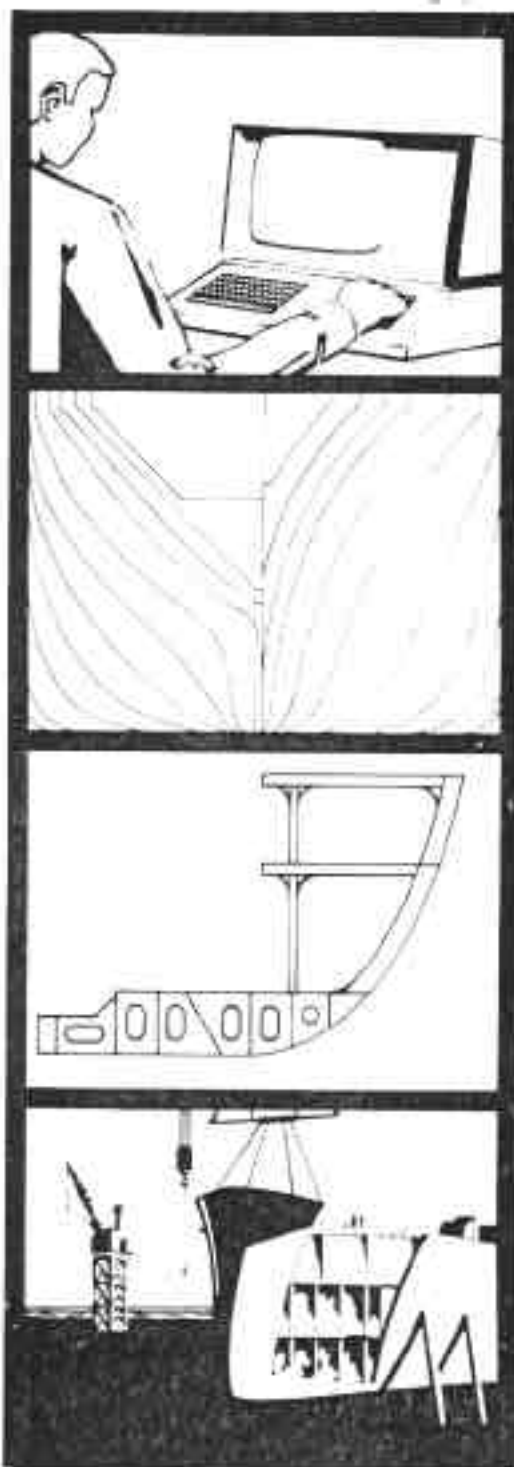
### **Paper No. 12: Network Scheduling of Shipyard Production, Engineering, and Material Procurement**

U.S. DEPARTMENT OF THE NAVY  
CARDEROCK DIVISION,  
NAVAL SURFACE WARFARE CENTER

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**R** RESEARCH  
**E** AND  
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**P** FOR  
**S** AUTOMATION  
 AND  
 PRODUCTIVITY  
 IN  
 HIGHBUILDING

Proceedings of the  
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**NETWORK SCHEDULING OF SHIPYARD PRODUCTION,  
ENGINEERING AND MATERIAL PROCUREMENT**

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**As Director of Shipyard Planning Services, Mr. Boucher is currently responsible for production planning and control services in shipyards, as well as system development and research. For the past 7 years, he has been involved in assisting various shipyards in the United States and Canada to improve their planning techniques and cost/schedule control systems. SPAR is currently engaged in providing production scheduling services to a number of yards in support of their planning staffs.**

**Prior to his involvement with SPAR, Mr. Boucher studied business administration and worked in management consulting.**

## PERT-PAC FEATURES

- \* Random network node numbering
- \* Multiple starting/ending, networks
- \* Sub-network, processing
- \* Multiple network processing
- \* Automatic network, loop detection
- \* Positive or negative activity lead time
- \* Automatic holiday and/or weekend schedule adjustment
- \* Automatic work week or shift adjustments
- \* Various activity sort list options
- \* Activity schedule bar charts
- \* Detailed node event schedule reports
- \* Summary milestone event schedule reports
- \* Critical activities analysis reports
- \* Activity cataloging to work breakdown structure, production work centers, ship zone, and/or steel unit.

PERT-PAC

SPECIAL BENEFITS

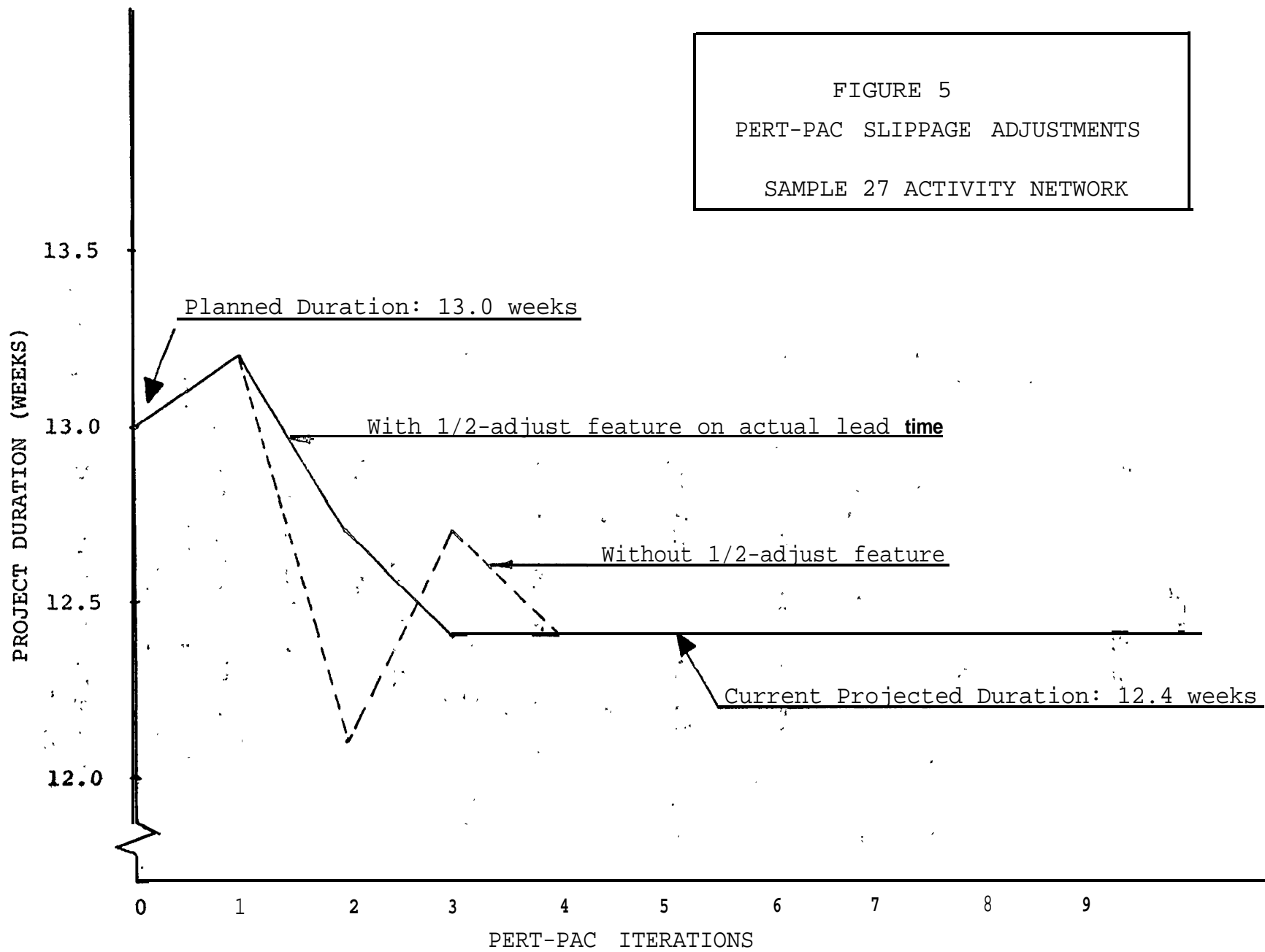
- \* Direct access to WORK-PAC and performance information
- \* Simultaneous processing of preliminary planning work packages with actual, detailed production work packages
- \* Automatic re-scheduling of WORK-PAC options
- \* Automatic network updating; manual progress assessments not required
- \* Automated in-progress work adjustments
- \* Automated completed work adjustments
- \* Automated lead time adjustments
- \* Management visibility through schedule summary reports

Milestone Report

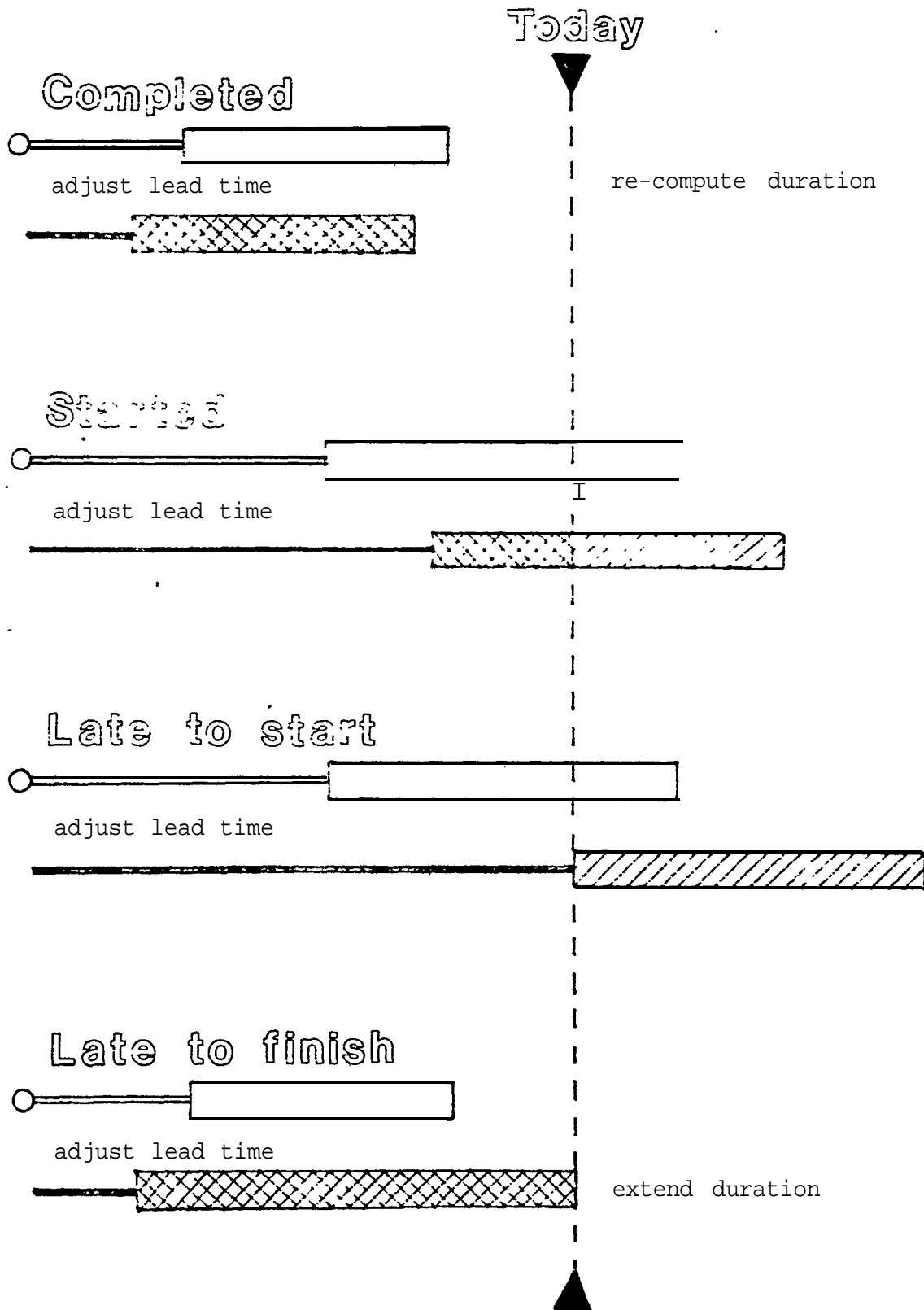
Critical Activity Report

- \* Schedule variance reporting
  - ' Automatic comparison of planned versus actual and current projected schedules
  - Total Project Slippage Report
- \* Automatic impact visibility of change orders and design changes

FIGURE 5  
PERT-PAC SLIPPAGE ADJUSTMENTS  
SAMPLE 27 ACTIVITY NETWORK



# AUTOMATED ADJUSTMENTS



## PERT-PAC CRITICAL ACTIVITY ANALYSIS

2/ 1/0

PAGE 1

| HULL W/C | PRG |       | PLANNED              |        |          | CURRENT |        | WKS   | DELAY  |
|----------|-----|-------|----------------------|--------|----------|---------|--------|-------|--------|
|          |     |       | START                | FINISH |          | START   | FINISH | STAKT | FINISH |
| 1980.    | 0.  | 300.  | REMOVE REFRACTIMATRL | 1/ 5/0 | 1/15/0 C | 1/ 3/0  | 1/14/0 | -0.3  | -0.1   |
| 1980.    | 0.  | 300.  | REMOVE AIR REGISTERS | 1/ 1/0 | 1/ 4/0 C | 1/ 5/0  | 1/ 7/0 | 0.6   | 0.4    |
| 1980.    | 30. | 400.  | INITIAL HYDRO TEST   | 1/ 1/0 | 1/ 5/0 C | 1/ 2/0  | 1/ 7/0 | C.1   | 0.3    |
| 1980.    | 0.  | 1300. | REPAIR INNER CASING  | 1/15/0 | 3/ 7/0 S | 1/11/0  | 3/ 3/0 | -0.6  | -0.6   |
| 1980.    | 0.  | 2300. | CHEM CLEAN TURBINE   | 3/ 7/0 | 3/11/0   | 3/ 3/0  | 3/ 7/0 | -0.6  | -0.6   |
| 1980.    | 0.  | 2400. | PRELIM HYDRO TEST    | 3/11/0 | 3/19/0   | 3/ 7/0  | 3/15/0 | -0.6  | -0.6   |
| 1980.    | 0.  | 2600. | INSTALL DRUM INTRNLS | 3/19/0 | 3/28/0   | 3/15/0  | 3/24/0 | -0.6  | -0.6   |
| 1980.    | 0.  | 2700. | FINAL HYDRO TEST     | 3/28/0 | 4/ 1/0   | 3/24/0  | 3/27/0 | -0.6  | -0.7   |
| 1980.    | 0.  | 2800. | INSTL PLASTIC REFPAC | 4/ 1/0 | 4/ 1/0   | 3/27/0  | 3/28/0 | -0.7  | -0.6   |
| 1980.    | 0.  | 1100. | EXPLORATORY BLOCK    | 1/15/0 | 1/30/0 S | 1/15/0  | 2/ 1/0 | 0.0   | 0.3    |
| 1980.    | 0.  | 1700. | R-R SPR HT TUBES     | 1/30/0 | 3/ 1/0   | 2/ 2/0  | 3/ 2/0 | 0.4   | 0.1    |
| 1980.    | 0.  | 2100. | REPAIR OUTER CASING  | 3/ 7/0 | 4/ 1/0   | 3/ 3/0  | 3/27/0 | -0.6  | -0.7   |
| 1980.    | 0.  | 500.  | REPAIR BILGE CASING  | 1/16/0 | 2/22/0 S | 1/17/0  | 2/22/0 | 0.1   | 0.0    |
| 1980.    | 0.  | 200.  | REMOVE BILGE CASING  | 1/ 1/0 | 1/16/0 C | 1/ 3/0  | 1/17/0 | 0.3   | 0.1    |
| 1980.    | 0.  | 1200. | FINISH REPAIR CASING | 2/22/0 | 3/25/0   | 2/22/0  | 3/26/0 | 0.0   | 0.1    |
| 1980.    | 0.  | 900.  | REMOVE DRUM INTRNLS  | 1/ 5/0 | 1/ 8/0 C | 1/ 3/0  | 1/ 9/0 | -0.3  | 0.1    |
| 1980.    | 0.  | 2200. | RE-BRICK             | 3/ 7/0 | 3/17/0   | 3/ 3/0  | 3/13/0 | -0.6  | -0.6   |
| 1980.    | 0.  | 2500. | INSTALL AIR REGISTRS | 3/17/0 | 3/25/0   | 3/13/0  | 3/21/0 | -0.6  | -0.6   |
| 1980.    | 0.  | 1800. | R-R SUPPORT TUBES    | 1/30/0 | 3/ 1/0 S | 1/27/0  | 2/25/0 | -0.4  | -0.6   |
| 1980.    | 0.  | 1000. | REPAIR SLIDING SEAT  | 1/23/0 | 2/22/0 S | 1/20/0  | 2/18/0 | 0.4   | -0.6   |
| 1980.    | 0.  | 600.  | INSPECT SLIDING SEAT | 1/16/0 | 1/23/0 S | 1/17/0  | 2/ 1/0 | 0.1   | 1.3 *  |

CURRENT SCHEDULE SLIPPAGES HAVE CAUSED NETWORK TO SLIP -0.57 WORK WEEKS = -2.8 WORK DAYS

TOTAL DURATION 1/ 1/0 THRU 3/28/0

12.43 WORK WEEKS = 62.14 WORK DAYS)

FIGURE 8: PERT-PAC Critical Activity Analysis

## MANPOWER PLANNING & CONTROL

From scheduled work packages, WORK-PAC develops

- \* Planned manpower
- \* Actual manpower expended to-date
- \* Projected manpower using production performance data

Special options include:

- \* Monthly averaging
- \* Trade breakdown detail
- \* Manpower Levelling
- \* Automatic generation of manhour "S" curve:
  - : planned
  - : actual
  - : projected

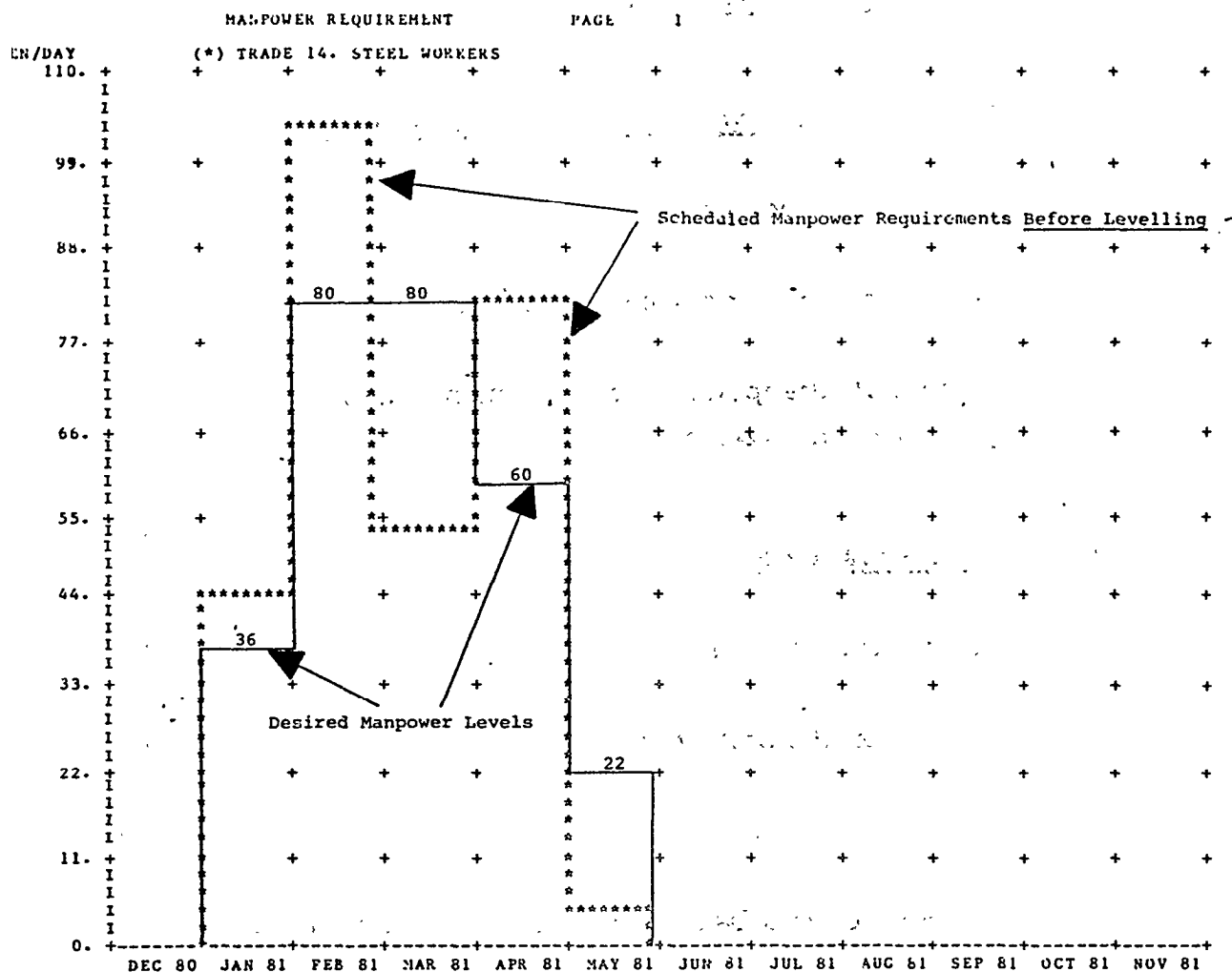


FIGURE 5c: Computer Generated (PERT-PAC) Manloading With  
Desired Manload Levels Superimposed

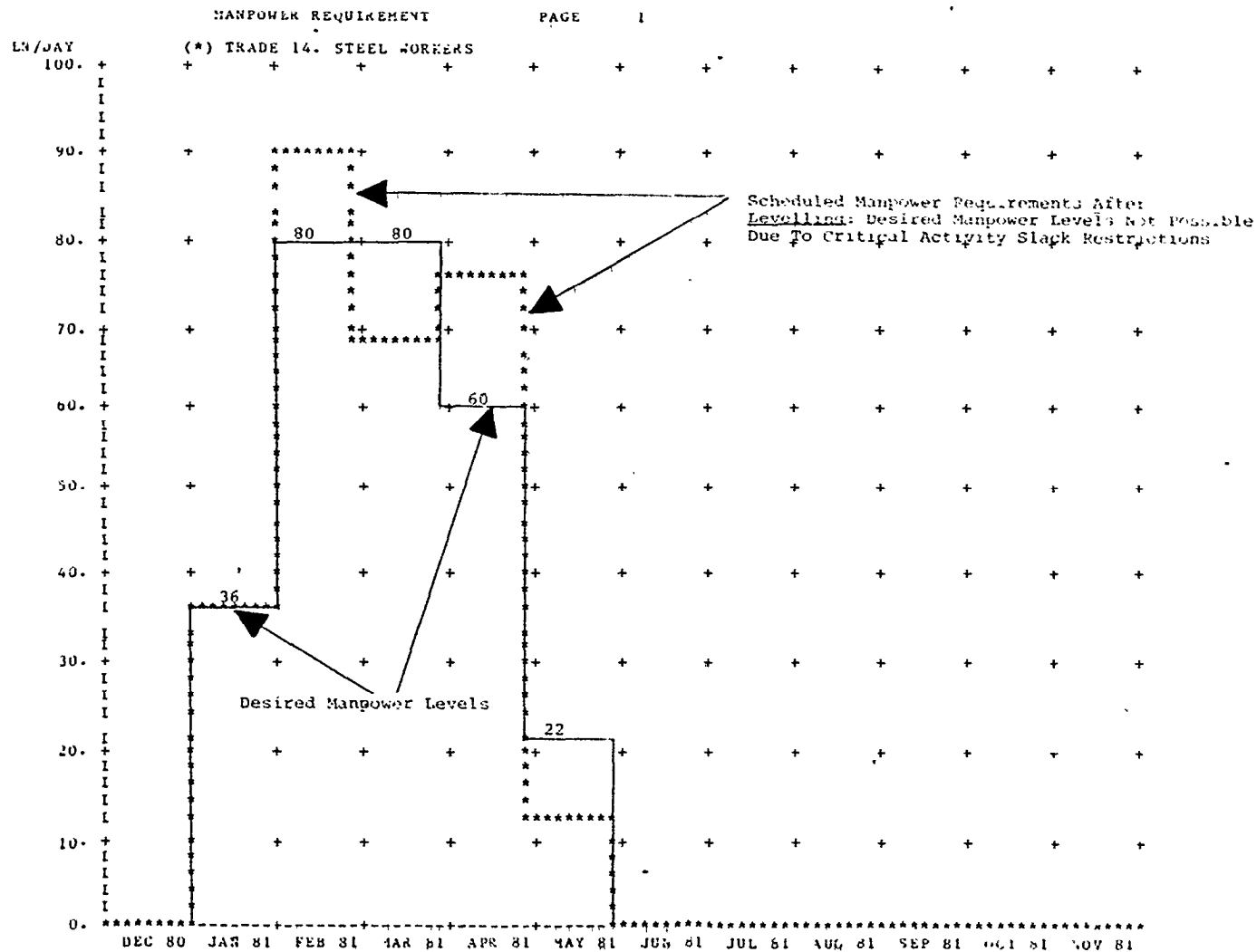


FIGURE 5d: Computer Generated (PERT-PAC) Levelling Of Manload Within Constraints Of Critical Delivery Schedules

## MICRONETS

### Pre-developed sub-networks:

- \* Can be used for any number of projects
- \* Can be used as often as needed within a given project
- \* Can be linked to other micronets

### major Benefits:

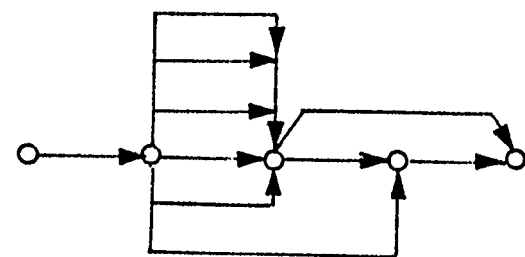
- \* Increased Confidence in Network By Production and Management
- \* Reduced Network Development, Efforts
- \* Reduced Data Errors
- \* Reduced Opportunities To Neglect Important Activities

### Disciplined & Orderly Network Logic:

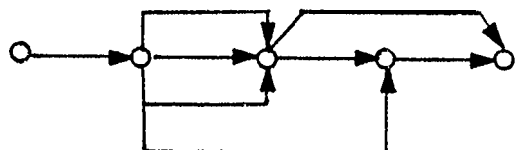
- \* 'Improved Visibility Even With More Detail
- \* Easier Networks To Modify'

### Special Feature

- \* Automated Activity Numbering
- \* Automated Node Numbering
- \* Automated Activity Budget Computations
- \* Automated Activity Duration Computations



Cloned & Modified  
Micro-net



# PROJECT NETWORK

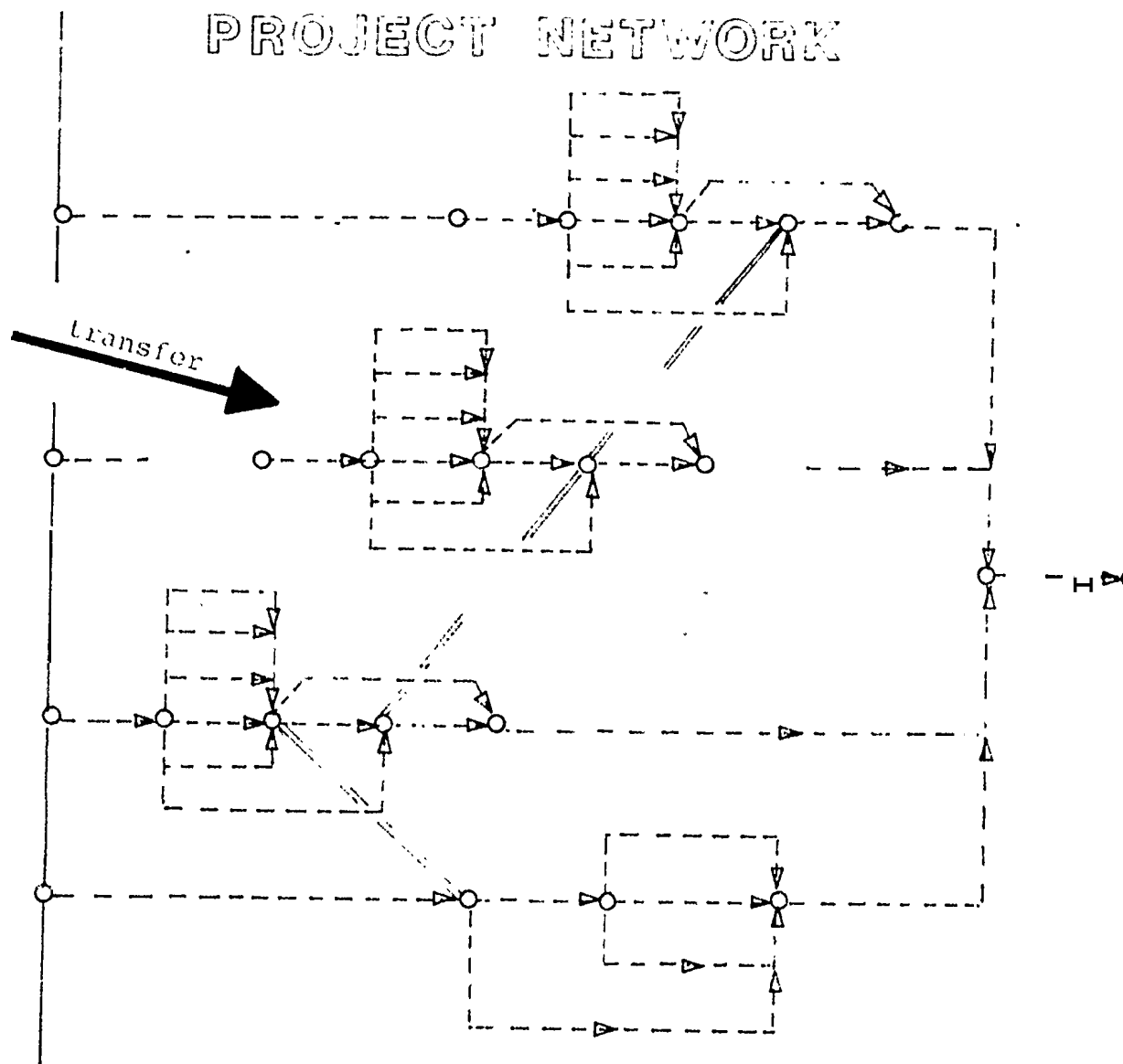
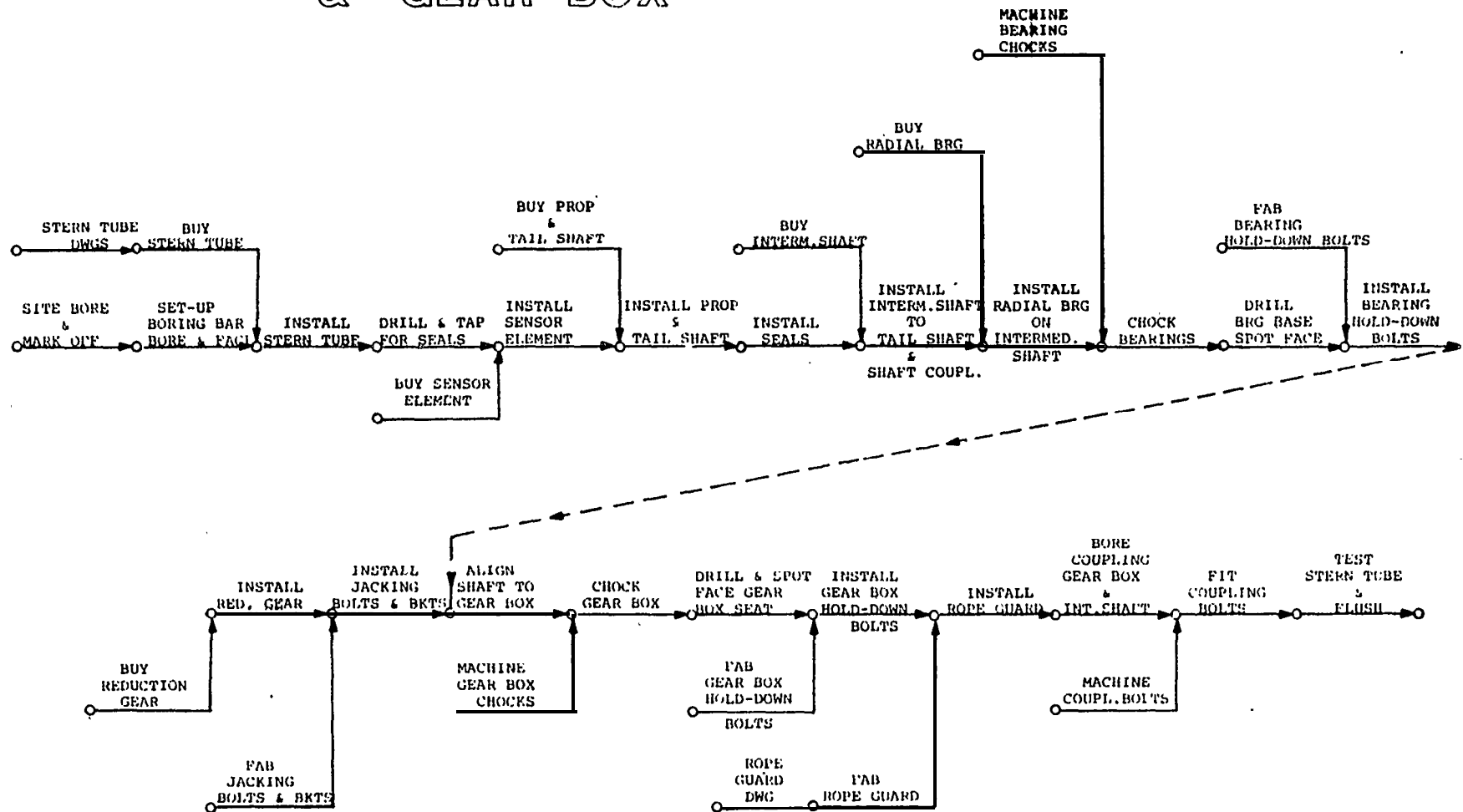


Figure 1: Transfer of micro- $ne$  from library to project network

# PROPELLER, STERN TUBE, SHAFTING & GEAR BOX



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